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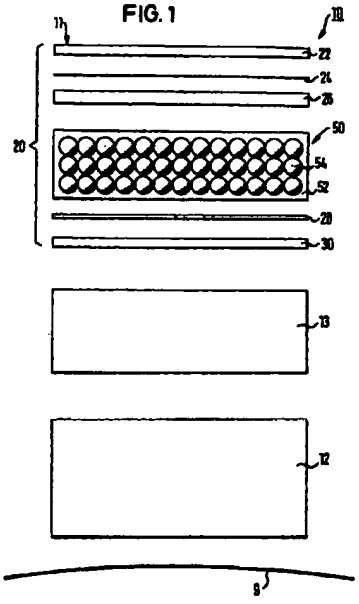
(54) Football

(57) The present invention relates to a ball, in particular a football. The ball according to the invention has, in its outer skin (11), a syntactic material (50) which consists of a matrix material (52) into which essentially dimensionally stable, elastic blow-moulded parts (54) are mixed. Furthermore, a new method of producing a ball with a verre églomisé print is also claimed.

FIG. 1



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Description

1. Technical Field

[0001] The present invention relates to a ball, and in particular a football, which comprises a top layer complex and, if appropriate, middle and backing layer complexes. Furthermore, the present invention relates to a method of producing a top layer complex of a ball.

2. Prior art

[0002] Various methods of producing balls are known from the prior art. In addition to the balls of a very simple construction (single-layer plastic balls), hand-sewn balls, in particular, were used in areas requiring high quality.

[0003] A known method of producing hand-sewn footballs, rugby balls, handballs, etc. is described, for example, in the document WO 95/09034. The construction of such a previously known ball and its production method are described below with reference to Figure 5.

[0004] A ball 10 of the hand-sewn type is illustrated in Figure 5. As can be seen from the figure, the ball 10 has an inflatable bladder core 9 which may consist, for example, of vulcanized latex. Located in the bladder core 9 is a valve (not illustrated) by means of which the ball can be inflated on completion. Located on the bladder core 9 in the example illustrated are three layer complexes: a structure 12 which may consist, for example, of two or more (three in the example illustrated) fabric layers is used as backing layer complex (also known as backing complex). The different fabric layers are bonded to one another by means of suitable binding agents (usually dispersions in an aqueous solution). A layer of polyethylene foam (PE) is used as middle layer complex 13. Finally, in the example illustrated, the top layer complex 14 consists of a transparent film. In this previously known ball, the decorative markings 15 on the ball (decorations, references to the manufacturer and registered trade marks, etc.) are located between the transparent layer 14 and the layer of polyethylene foam 13.

[0005] A previously known ball 10 of this type is produced by having the decorative markings 15 applied to the inner side of a finished transparent outer layer 14. Subsequently, the middle layer complex 13 and the backing layer complex 12 are laminated onto the printed side of the transparent covering layer 14. Subsequently, the laminate (produced over a large area) is punched in order to produce flat shapes (the usual triangles, pentagons, hexagons) which, when joined together, result in a hollow sphere. The ball elements are then sewn together by hand, and the ball skin, produced in this way, is then placed on the inflatable core 11 (in the case of a laminated ball), or the inflatable core (11) is inserted into the ball skin, produced in this way before it is closed (in the case of a hand-sewn ball).

[0006] In a ball of the non-hand-sewn type, in which an inflatable core is wrapped with a multidirectional filament structure which is stabilized and held together by means of vulcanizable bonding, the top layer complex 14 produced according to the above method can be bonded into correspondingly provided recesses in the filament structure with the aid of a nonwoven material (a felt or mat).

[0007] However, previously known balls of this type and the production method described have the following disadvantages: on the one hand, the trajectory properties of balls of this type are not optimum owing to the structure of the outer skin. The same applies to the bounce properties and the impact characteristics of the ball. Furthermore, a disadvantage of the production method described above consists in the fact that, because the foam layer 13 is laminated onto the printed, prefabricated film 14, the bonding of these layers to one another is not optimum, which has an adverse effect on the abrasion resistance of the markings 15. Furthermore, although the PU films used for the transparent film are light stabilized, they are not lightfast. As a result, undesirable "yellowing" of the ball may occur through the adhesive bonding. Finally, the transparent PU films have the disadvantage that they are slippy in a wet environment, which makes the ball difficult to control.

[0008] The object of the present invention is therefore to provide a ball and a method of producing it, according to which a ball of a high quality can be produced, has optimum bounce and trajectory properties, feels "soft" on the foot, and is fast in flight, and permits optimum handling and optimum ball control the said quality meeting and being even better than the specifications required by FIFA. Furthermore, the ball should have a high degree of roundness and dimensional stability and display a high degree of abrasion resistance and a low degree of water absorption. The production method should enable balls having the abovementioned properties to be produced in a reproducible manner.

3. Summary of the Invention

[0009] The abovementioned problems are solved according to the invention by a ball according to Patent Claim 1 and by a method of producing a top layer complex of a ball according to Patent Claim 17.

[0010] Specifically, the problems underlying the invention are solved by a ball, in particular by a football, whose outer skin has a syntactic material.

[0011] Syntactic materials are mixtures which consist of a matrix material into which essentially dimensionally stable solid bodies are mixed.

[0012] A subcategory of syntactic materials which are particularly preferred according to the present invention are syntactic foams which, in contrast to conventional foams, are not expanded by means of a chemical propellant or water, but by mixing in elastic, preferably spherical hollow spheres.

[0013] The microspheres which are particularly preferred according to the present invention can be procured commercially, for example under the trade name "DUALITE". DUALITE hollow spheres are spheres which are closed in the manner of a balloon and can be filled either with air or with another suitable gas, as a result of which, on the one hand, they are compressible and, on the other hand, assume their original shape again as soon as the pressure acting upon them diminishes. Soft microspheres of this type are extremely pressure-resistant and burst only under very high pressures.

[0014] The above properties lead to the fact that syntactic foams have excellent properties of elasticity, which results in excellent bounce characteristics when they are used in balls and, in particular, in footballs.

[0015] Syntactic foams are known per se. They are used, in particular, in aerospace technology, where there is a high requirement for epoxy resin or similar engineering resins as construction material. However, a disadvantage of pure epoxy resin consists in the fact that it has a considerable density and thus a considerable weight, and it cannot be foamed to reduce the weight. For this reason, consideration was given to embedding hollow glass spheres in epoxy resin in order to reduce their weight and increase the stability. Up to now, however, syntactic foams have only been used to increase the stability of the matrix material and to reduce its weight at the same time.

[0016] Up to now, no consideration has been given to using syntactic foams in outer skins of balls.

[0017] Furthermore, the present invention comprises a method of producing a top layer complex of a ball, in particular a football, which comprises the following steps:

a. spreading a transparent liquid polymer over a backing film and subsequently solidifying the liquid polymer in order to produce a transparent layer of plastic;
b. printing a desired pattern or symbol on the solidified transparent layer of plastic;
c. spreading a second liquid polymer over the solidified, transparent and now imprinted layer of plastic and subsequently solidifying the second liquid polymer in order to produce a layer combination;
d. cutting the layer combination in order to produce ball elements; and
e. subsequently joining the ball elements together, possibly with further ball layer complexes and an inflatable bladder in order to produce the ball.

[0018] The inventive method of producing a top layer complex differs from the previously known production method described above in that no prefabricated transparent plastic film is used, but firstly only a high-gloss release paper over which a transparent liquid polymer is spread using a spreading doctor knife. The liquid polymer spread on is subsequently solidified in an oven, preferably by means of heat treatment, and is then printed. In a second production operation, a liquid polymer is again spread over the transparent, printed layer of plastic produced in this way and, like the first layer of plastic, is solidified by means of an oven, preferably by the action of heat.

[0019] The layer combination produced in this manner is distinguished by the fact that particularly intimate bonding of the two layers can be achieved by having the second liquid polymer layer spread on and subsequently solidifying it, which bonding behaves in such a way, with regard to its elastic properties, as if it were made of only one layer. The markings printed on the back of the first solidified layer of plastic are, so to speak, cast in by having the second liquid polymer layer spread over them and are thus sealed so that the markings are extremely resistant to abrasion against friction forces occurring within the outer skin.

4. Brief description of the drawing

[0020] The currently preferred embodiments of the present invention are described below with reference to the drawing, in which:

Figure 1 shows a cross-section through the inventive layer structure of the outer skin of a ball;
Figure 2 shows a comparison of the bounce heights of a ball, produced according to the present invention, with previously known balls according to the prior art as a function of temperature;
Figure 3 shows a diagram in which the bounce speed as a function of the pressure of a ball according to the present invention is compared with previously known balls;
Figure 4 shows a diagram in which the impact characteristics of a ball according to the invention as a function of the ball pressure is compared with previously known balls; and
Figure 5 shows a cross-section through the skin of a previously known ball according to the prior art.

5. Description of the preferred embodiments

[0021] The currently preferred embodiments of the present invention are described below with reference to the drawing. However, it is expressly pointed out that the present invention is not limited to these embodiments, but also includes others. In particular, the present invention should not be restricted to footballs, but be applied to all types of balls.

[0022] The first preferred embodiment of the present invention is illustrated in Figure 1. A cross-section through the outer skin 11 of a ball 10 according to the

invention can be seen. In the embodiment illustrated, the outer skin 11 consists of a top layer complex 20, a middle layer complex 13, and a backing layer complex 12, which complexes are located on an inflatable bladder core 9 (the middle layer complex 13 and the backing layer complex 12 are illustrated only diagrammatically). The inflatable bladder core 9 has an inlet (not illustrated) which is provided with a valve and by means of which the ball can be inflated when it has been produced. The backing layer complex 12 preferably comprises two to four (three in the example shown) separate fabric layers which may consist of polyester fabrics in a basket weave or similar type of weaving, or knitted fabrics. The middle layer complex 13 preferably consists of polyethylene foam.

[0023] It is pointed out that the construction consisting of the inflatable bladder core 9, the backing layer complex 12 and the middle layer complex 13 is known per se and is used in the prior art in hand-sewn balls.

[0024] According to the first preferred embodiment of the present invention according to Figure 1, the syntactic material according to the invention is used in the top layer complex 20 which, in the embodiment illustrated, consists of six individual layers.

[0025] The outer layer 22 involves an aliphatic transparent layer which has extremely high strength and abrasion resistance, and which is resistant to undesirable yellowing when it ages. The next layer 24 involves the markings which, when the ball has later been fitted together, determine its exterior decorative appearance. Since the outer layer 22 is transparent, the markings (usually decorations, trade marks or other inscriptions) are visible through the transparent layer 22. As will be explained in greater detail later, this layer is printed on the later inner side of the aliphatic outer layer 22 using a screen printing or transfer printing method.

[0026] The next layer 26 in the sequence of layers involves an aliphatic middle layer which is preferably white but can also be of a different colour, such as for example fluorescent green or fluorescent red. Fluorescent green or fluorescent red balls are popular, in particular, in games which take place at dusk. The layer 26 gives the later ball its familiar white (or coloured) appearance.

[0027] The next layer 50 in the sequence of layers involves the syntactic foam layer according to the invention. According to the preferred embodiment, polyurethane is used as matrix material 52 into which hollow spheres 54 are mixed. However, polyurethane foams or PVC can also be used. The hollow spheres 54 can be obtained commercially, for example under the name "DUALITE" from the company ÖLW AG (Traiskirchen, Austria). This material involves expanded thermoplastic microspheres which consist of acrylonitrile copolymers. DUALITE has the appearance of a white powder whose specific density is 0.13 g/cm^3, the diameter of the individual microspheres being about 70 µm. The DUALITE microspheres have a high compression stability; they can be loaded with a pressure of up to 140 kg/cm^2 without breaking. DUALITE is available from different manufacturers under different trade names in different densities and sizes.

[0028] According to the invention, different mixing ratios between the matrix material 52 and the microspheres 54 were examined with regard to their suitability for use in balls. It was shown that the proportion of microspheres 54 in relation to polyurethane 52 is preferably between 1% by weight to 20% by weight, furthermore preferably between 2% by weight and 5% by weight, and particularly preferably about 4% by weight. The use of a layer 50 of syntactic foam gives the later ball the excellent elasticity and bounce properties (see below).

[0029] The next layer 28 in the sequence of layers involves an adhesive layer (a polyurethane adhesive) which serves to bond the sixth layer of the sequence of layers (a backing layer 30) to the sequence of layers 22, 24, 26 and 50. The backing layer 30 preferably consists of a fabric of mixed polyester and cotton.

[0030] The excellent properties of a ball with the above construction can be attributed to the use of the syntactic foam according to the invention. The foam layer 13 conventionally used in the prior art (see Figure 5) has a nonuniform bubble structure inside it, since it has been expanded in a conventional manner (either chemically or using water). The bubbles produced in this way only have a spherical shape in exceptional cases; the air entrapments which develop are usually kidney-shaped or randomly shaped. This results in the uneven and therefore undesirable elasticity properties of the ball.

[0031] In contrast, in the present invention, all the hollow spheres used are largely identical; they have precisely defined elasticity and temperature characteristics. Both the elasticity characteristics and the temperature characteristics of the ball can be adjusted according to the invention in that the microspheres, instead of being filled with air, are filled with a specific gas at a specific pressure.

[0032] The inventive method of producing the top layer complex 20 according to the invention is described below with reference to Figure 1.

[0033] According to the invention, firstly a high-gloss release paper, which is commercially available as piece goods, is mounted on a rotatable roll, and the end of the high-gloss release paper is attached to an empty roll which can be driven by means of an electric motor, as a result of which the high-gloss release paper is wrapped around the empty roll. Located between the rotatable roll and the driven roll is a workbench over which the high-gloss release paper is slowly drawn as a result of the rotation of the driven paper roll. Furthermore, an oven is located between the driven empty roll and the paper roll, through which oven the high-gloss paper is slowly drawn before it rolls up on the empty roll.

[0034] Located in front of the oven is a supply arrange-

ment with a spreading doctor knife which serves to apply the liquid aliphatic material of the transparent outer layer 22 to the slowly moving high-gloss release paper and to distribute it as a uniform layer. After the liquid aliphatic material has been distributed to form a uniform film with the aid of the spreading doctor knife, it passes through the oven, where it is allowed to evaporate and becomes crosslinked. Only then is it rolled up on the empty roll as a result of the rotation of the latter until a roll is thus produced, consisting of the high-gloss release paper and the transparent outer layer 22.

[0035] The desired markings, decorations or the like are then subsequently printed on this roll by means of a screen printing or transfer printing device which is known per se. The roll obtained in this manner (now consisting of the high-gloss release paper, the outer layer 22 and the verre églomisé print 24) is subsequently again introduced into the device described above to produce the outer layer 22, although this time the supply container contains the liquid material of the aliphatic white middle layer. Furthermore, the spreading doctor knife can be adjusted in a suitable manner in order to set the required thickness of the aliphatic middle layer 26.

[0036] When this layer has also been allowed to evaporate and become crosslinked on its way through the oven, the roll thus obtained (now consisting of the high-gloss release paper, the outer layer 22, the verre églomisé print 24 and the middle layer 26) is again introduced into the device described above to produce the outer layer 22. This time, however, the supply container contains the inventive syntactic foam 50. According to the invention, the latter is also spread over the layer combination already present to the required thickness and is dried by means of the oven.

[0037] Finally, the layer combination thus produced (now consisting of the high-gloss release paper, the outer layer 22, the verre églomisé print 24, the middle layer 26, the layer of syntactic foam 50) is provided with the adhesive layer 28. According to the invention, this is also carried out by means of a device as was described above for applying the outer layer 22. However, in this last step, before the spread-on, still liquid adhesive layer 28 is hardened on its way through the oven, the backing layer 30 is placed from above on that side of the still liquid adhesive layer 28 which faces the inside of the ball, and is pressed on by means of a roller. The now complete layer combination then passes through the oven to allow it to evaporate and become crosslinked, the high-gloss release paper being pulled off, as a last step of the method, from the top layer complex which is now complete.

[0038] Alternatively, the above production operation can also be completed in a single production line, in which the individual layers are applied at individual doctor knife/heating stations.

[0039] The top layer complex 20 thus obtained as an endless web is then bonded to the middle layer complex 13 and the backing layer complex 12. This takes place, for example, using natural latex. Additionally, this now complete surface complex provided with the verre églomisé print can be printed with other motifs in a conventional manner.

[0040] Finally, the ball skin 10 thus obtained is cut (punched) in order to produce the individual (usually pentagonal or hexagonal) ball elements which are subsequently sewn by hand to produce the finished ball 10.

[0041] In the first embodiment described above, the syntactic material according to the invention is used as a foam layer 50 in the top layer complex 20 of the ball skin 11. According to another, further preferred embodiment of the present invention, it is, however, likewise possible, in addition or instead, to mix the microspheres 54 according to the invention into the latex material, by means of which the top layer complex 20, the middle layer complex 13 and the backing layer complex 12 are bonded to one another. This has the advantage that, on the one hand, the elastic properties of the ball are further improved as a result and, on the other hand, the weight of the ball can be reduced since natural latex actually has a considerable weight.

[0042] As has been described in detail above, the ball according to the invention has improved properties in comparison with previously known balls. This is to be explained in greater detail below with reference to Figures 2-4.

[0043] In Figure 2, the bounce height of the ball according to the invention was compared with the bounce heights of previously known balls, specifically at different temperatures. In this case, the respective balls were dropped from a height of 2 metres, and the bounce height (= rebound height) was measured. The ball (Wc 1998) according to the invention was compared with the previously known balls Questra Apollo and Questra Wc 1994, specifically at room temperature (RT) and at 5°C. As can be seen from the diagram, the bounce height of the ball according to the invention was 1.50 m at room temperature, whereas it was only 1.45 m and 1.46 m respectively for the previously known balls. At 5°C, the difference turned out to be even greater: whereas the bounce height of the ball according to the invention was 1.37 m, the previously known balls bounced only to a height of 1.29 m and 1.28 m respectively. The comparison thus shows that the ball according to the invention not only has improved bounce properties, but, in this regard, also shows less dependence on temperature.

[0044] Figure 3 illustrates the bounce speed as a function of the ball pressure, the ball according to the invention again having been compared with the previously known balls mentioned above. As can be seen from the diagram, the ball according to the invention shows higher bounce speeds than the previously known balls over the entire ball pressure range illustrated.

[0045] Finally, Figure 4 shows the response characteristics of the ball with regard to impacts (shock characteristics) as a function of the ball pressure. As can be seen

from the diagram, the ball according to the invention generates less impact shock than the previously known balls, in particular at low ball pressures. This indicates the improved elasticity characteristics of the ball according to the invention.

[0046] Finally, it should be established that the inventive concept of using a synthetic material is not limited to hand-sewn balls, but can also be used for laminated balls. In this case, the backing layer complex is replaced by the carcass. The same applies to the inventive method of producing a top layer complex for a ball.

Claims

1. Ball, in particular a football, whose outer skin (11) has a syntactic material (50).

2. Ball according to Claim 1, in which the syntactic material (50) comprises a matrix material (52) into which essentially dimensionally stable, elastic blow-moulded parts (54) are mixed.

3. Ball according to Claim 1 or 2, in which the outer skin (10) of the ball consists of a top layer complex (20) and a backing layer complex (40).

4. Ball according to Claim 3, in which the outer skin (10) additionally has a middle layer complex (45).

5. Ball according to one of the preceding Claims 2 to 4, in which the syntactic material preferably comprises polyurethane, polyurethane foams or PVC as matrix material (52) which, when mixed with the hollow spheres (54), configured as a layer, forms an element of the top layer complex (20).

6. Ball according to Claim 5, in which the syntactic material (50) configured as a layer is arranged between layers (22, 24, 26, 28, 30) which likewise belong to the top layer complex (20).

7. Ball according to Claim 5 or 6, in which the top layer complex (20) comprises a transparent outer layer (22), a verre églomisé print (24) imprinted on the inner side of the transparent outer layer (22), a middle layer (26), an adhesive layer (28) and a backing layer (30), the syntactic material (50) configured as a layer being arranged between the middle layer (26) and the adhesive layer (28).

8. Ball according to one of the preceding Claims 3 or 4, in which the layer complexes (20, 40, 45) forming the outer skin (10) are bonded to one another by means of a binding agent, the said binding agent comprising the syntactic material (50).

9. Ball according to Claim 8, in which the matrix material (52) is natural latex.

10. Ball according to one of Claims 2 to 9, in which the proportion of blow-moulded parts (54) relative to the matrix material (52) preferably makes up 1% by weight - 20% by weight.

11. Ball according to one of Claims 2 to 9, in which the proportion of blow-moulded parts (54) relative to the matrix material (52) preferably makes up 2% by weight - 5% by weight.

12. Ball according to one of Claims 2 to 9, in which the proportion of blow-moulded parts (54) relative to the matrix material (52) preferably makes up 4% by weight.

13. Ball according to one of Claims 2 to 12, in which the diameter of the individual blow-moulded parts (54) is between 50 µm and 100 µm.

14. Ball according to one of Claims 2 to 12, in which the diameter of the individual blow-moulded parts (54) is 70 µm.

15. Ball according to one of the preceding Claims 2 to 14, in which the blow-moulded parts (54) consist of thermoplastic, expanded, spherical hollow spheres.

16. Use of a syntactic material in the outer skin (12) of a ball, in particular a football.

17. Method of producing a top layer complex of a ball, in particular a football, which comprises the following steps:

    a. spreading a transparent liquid polymer over a backing film and subsequently solidifying the liquid polymer in order to produce a transparent layer of plastic;
    b. printing a desired pattern or symbol on the solidified transparent layer of plastic;
    c. spreading a second liquid polymer over the solidified, transparent and now imprinted layer of plastic and subsequently solidifying the second liquid polymer in order to produce a layer combination;
    d. cutting the layer combination in order to produce ball elements; and
    e. subsequently joining the ball elements together, possibly with further ball layer complexes and an inflatable bladder in order to produce the ball.

18. Method according to Claim 17, which furthermore comprises the step: spreading a layer of a syntactic material (50) over the inner side of the layer combination (20, 24, 26).

19. Method according to Claim 17, which furthermore

has the step: spreading an adhesive layer (28) over the layer of the syntactic material (50), and subsequently placing on a backing layer (30).

20. Method according to one of Claims 17 to 19, wherein the step of solidifying the liquid polymers takes place by means of heat treatment.

FIG. 1

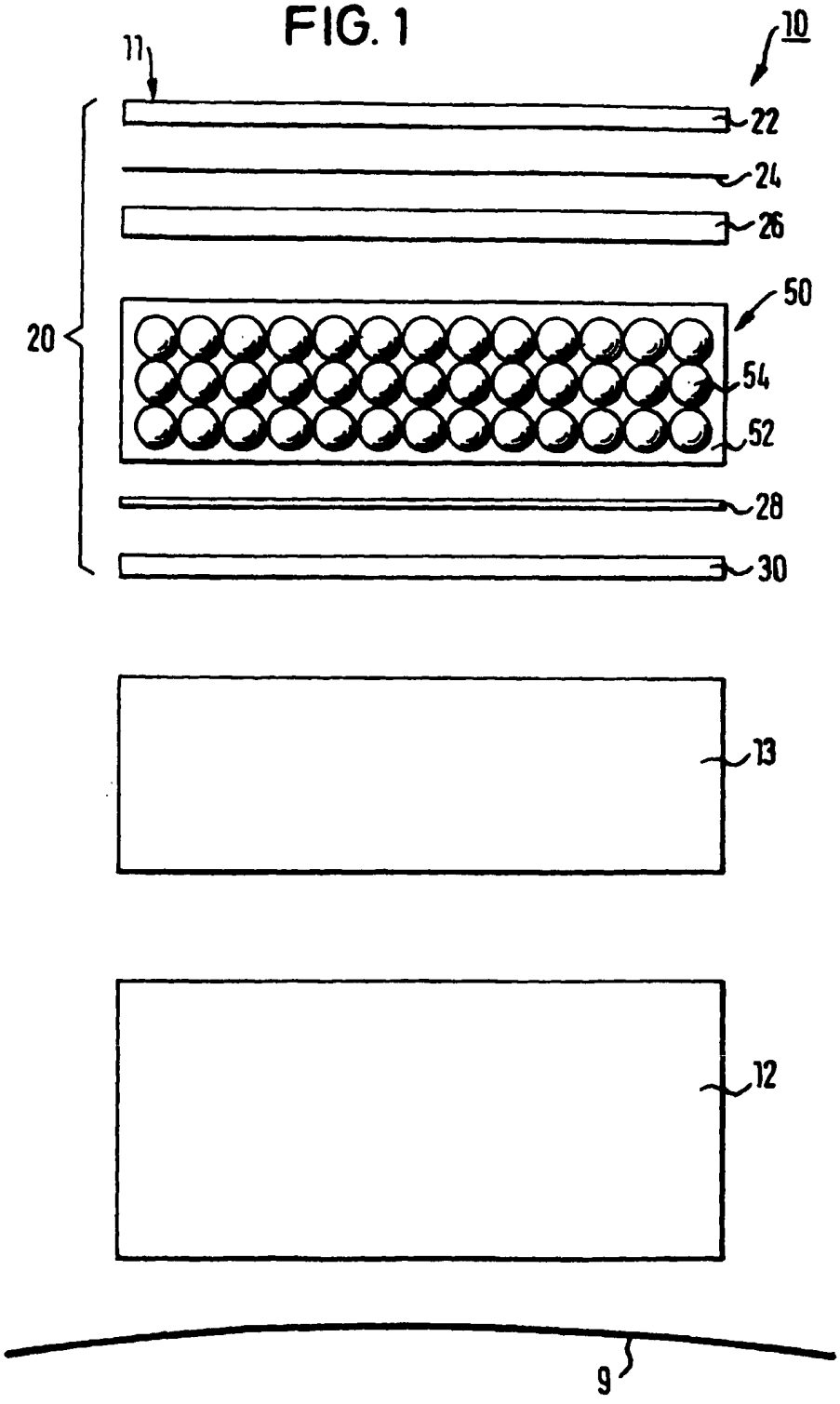

FIG. 2

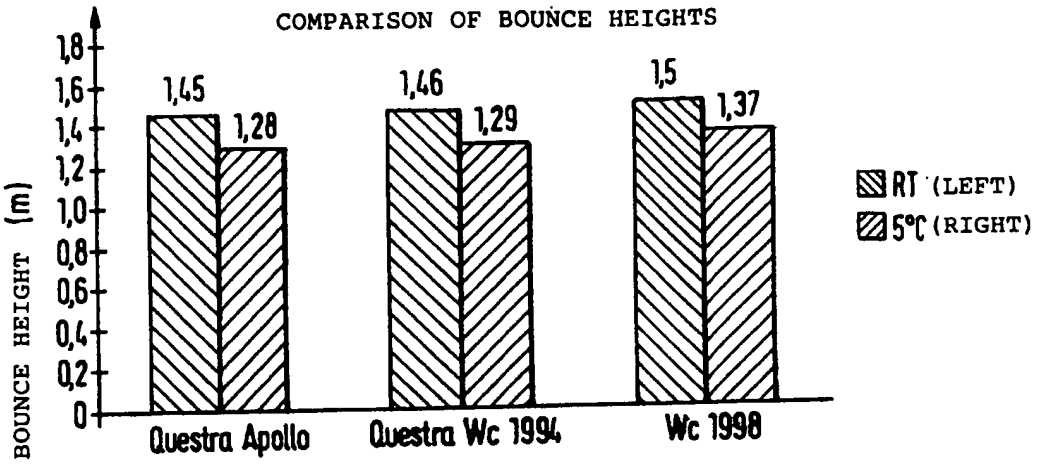

FIG. 3

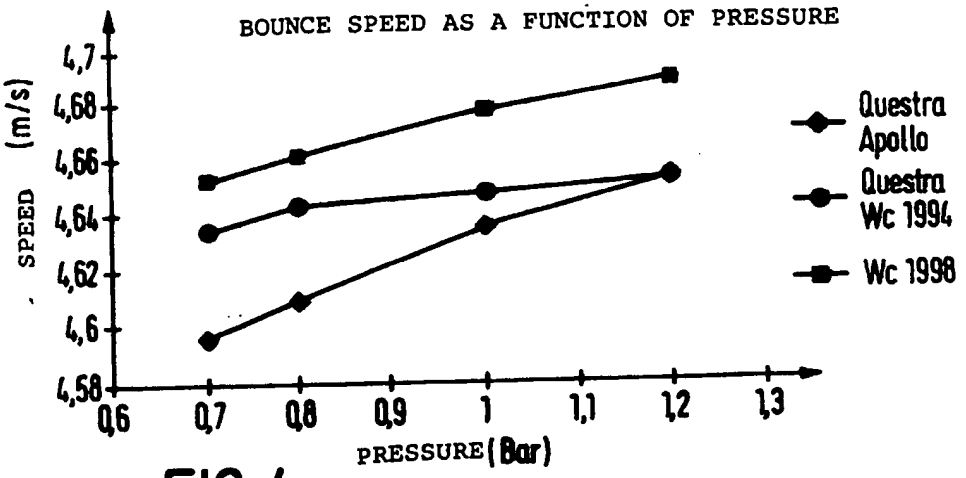

FIG. 4

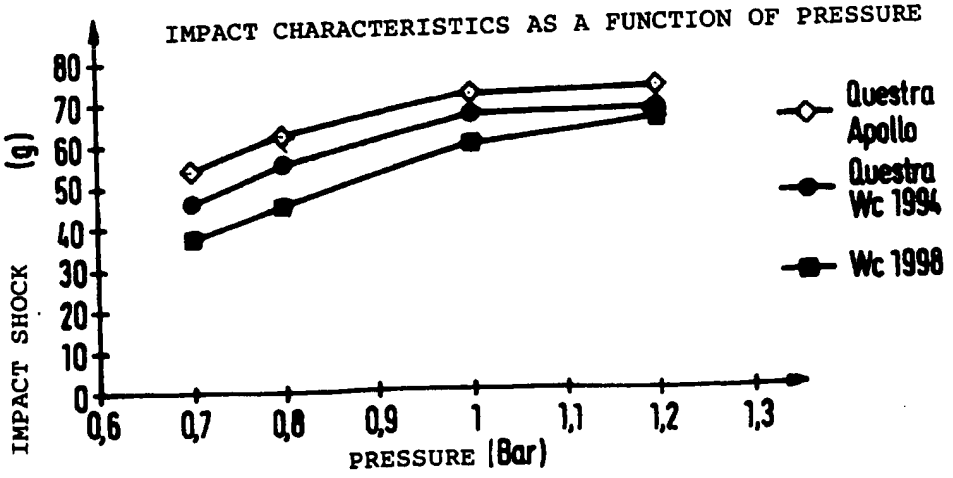

FIG. 5

(PRIOR ART)